TOPOLOGY FOR NEXT GENERATION ACCESS NETWORK

Adam Kovář

Bachelor Degree Program (3.), FEEC BUT

E-mail: xkovar75@vutbr.cz

Supervised by: David Grenar

E-mail: xgren04@vutbr.cz

Abstract: This article consists of basic requirements, application of optical fibers and final simulation of this network in specific location. This template shows ideal construction of optical fiber network for this chosen location and also displays expected price of building this design of network. During making this work we have discussed all technologies which are possible to implement. We chose optical fiber with the right protection to be able to actually perform in the given location. As a final part of this work is also said which technology and where is it going to connect the people households in the village and as well as it is dealing with the industrial part of the village on the opposite side. For better understanding I attached a map showing the best path for the network best possible location. There is simulation which uses applications such as FTP, web browsing, multimedia content, VoIP and etc. that covers basic traffic on network and helped us to choose the topology compromising price and delay.

Keywords: Optical fiber. Single mode. Multimode. Protection. Optical fiber welding. Connecting of optical fibers. Attenuation. Optical fiber track. Excavation work. Setting up optical fiber. Blowing the optical cable. Connection of customers.

1 INTRODUCTION

This article aims to problematics connected to planning and network development of new generation access networks in terms of optical fiber medium. Network development of high speed access networks is really discussed topic in terms of needs to deliver high speed internet connection in order to cover all the needs of to get multimedia content and also to work with desired date from IoT which can flood network and result in collapse. This location is in interesting location and it is relatively close to back bone optical fiber network.

Content of this work consist of planning how to connect to backbone network and extend its network in the village Svitávka. Also, in next part is proof that built network can operate so I made a simple simulation of actual network topology to get information about functionality of the network with moderate application profiles which offers to run basic application on server and PCs to prove the usability and stability while it is in operation. There is idea of implementing some of the wireless access point to the most frequented places in village such as park and main square. This is nowadays trend which to enable people to make internet connect via Wi-Fi in such as places overseas, so it is time to count within our planning.

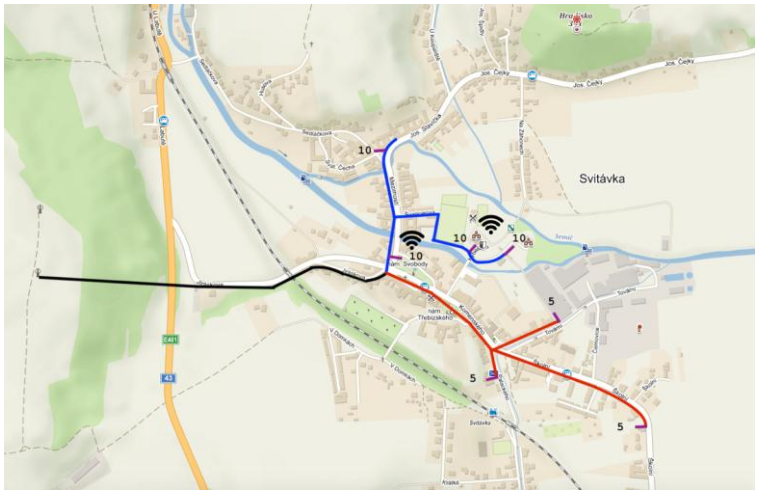
2 DESIGN OF ACCESS NETWORK

Main goal is to build as well as simulate network model which will be transparent enough to show how extending of this kind of optical fiber networks in villages can be build. This article deals with basic coverage in the location in order to deliver it as easy as possible in order to expand this network in future. That means we were placing the route of the optical fiber in more frequented places to offer possibility to add more branches in access network. Right now, it is planned to connect most frequented areas and most dense places in the village. Ability to be expandable later is really

important factor which needs to be considered while planning this kind of backbone network for chosen location. [1] [2]

2.1 LOCATION

Chosen destination Svitávka is located 40 km north from Brno. Even though, it is pretty small village various investors build industrial building and the growth of the village in last few years is really makeable. The plan is to connect the industrial part and also the residential part of the village to backbone optical fiber network nearby. The actual backbone network is owned by internet service providers which are offering great stability and high-speed connection. Due to their radio transmitter from different sites which are delivering data in case of some kind of error occurs during usage it is really reliable. The sites are covered by batteries backup which are granting its functionally up to 12 hours while an actual black out can happen.



Obrázek 1: Map of the optic fiber network

2.2 TECHNOLOGY

Route of optical fiber will be placed using excavation work only outside the village. In the location will be used technology called MCS-Road which is actually process when you make small channel into road or sidewalk where will be afterwards places the optical fiber. This technology is more expansive, but it will offer us ability to limit disrupt traffic in village to minimum what is really important due to existence of industrial buildings in the village. Own cable will be placed into HDPE tube with diameter of 40 mm where can be placed up to 19 micro fiber cables. We will squeeze into HDPE tube for example this micro fiber cable SXKO-MICRO-24-OS-HDPE. At the end of each branch will be placed switchboard which will deliver internet to desired place. [1] [2]

In industrial area will be build optical fiber network using technology FTTB (Fibre to the buiding) which deliver active element (switch) right on the inside wall of the desired building. Also, in addition there will be possible to connect to network through wireless access points or using ethernet cable. For residential are we will find must convenient place to connect as many customers as possible in closest distance to lower prices of additional expenses for customers. On public places we will place wireless access point which will offer 2.4 GHz and 5 GHz frequency which will offer to deliver reliable connection to stream multimedia content. [1]

2.3 MAP BACKGROUNDS

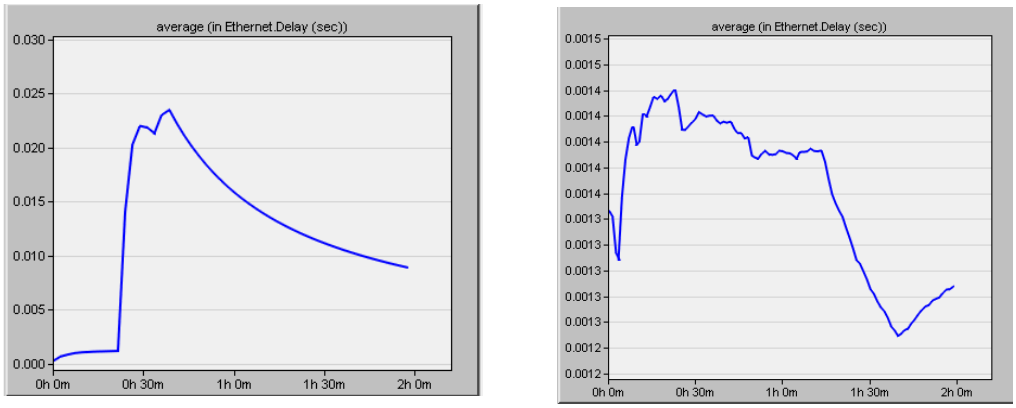
On this attached map we can see highlighted route from access point to backbone networks of its length 1.3 km. This route is heading towards 43/E461 going under through tunnel which will have to be dug under to limit traffic as less as possible also. The route will continue along the 37420 and

optical cable will be still placed just by simple excavation work after it enters the village it will change. The route is heading to main square and from there it is splitting into two. One is heading to residential part of the village (blue color) and the other to industrial (red color). Next but not last, information from this map is the purple colored marks which represent switchboards where is going to be possible to connect via cable to the high-speed internet connection. Number next to it is number of devices representing actual PC users placed for simulation in order to simulate the network in real time.

2.4 SIMULATION

Actual simulation was built in RiverBed application with offers various application and profile configuration to run on the server and start on single PC. Each application profile is configured in specific order that means we can set up how big usage of network will it use and also when they should turn on and how long should they work. All the applications are set to maximum level that means that actual delay times will be much smaller in real network.

The key of this simulation is to show the network delay while the network will be in use. First 15 minutes represent usage in residential area and using basic network applications, next 30 minutes is displaying industrial part which consist of more demanding applications and the rest of this are wireless access points. Comparison between these two pictures is delay depending on the chosen topology. Left one picture is tree and the other one is story topology. Delay on story topology is smaller but compared to the tree topology is not that striking so we can choose tree topology. Also, in addition we can see that even maximum usage if applications in residential area has small impact on the delay in network. On the other hand, the middle the industrial has the most traffic and that's the reason why we chose the FTTB technology to limit this delay to minimum. Both topologies run the same application profile at the same time.



Obrázek 2: Comparison between delay on different topologies.

3 CONCLUSION

This article aims on implementing optical fiber networks in rural areas and analyzing possibilities. Also, one of the corner stones of this paper is actual proposal of network in chosen location with simulation which is proving its stability and also show us the actual usage of network and resulting in which technology should be implemented to make it the most reliable.

REFERENCES

[1] FILKA, Miloslav. *Optoelektronika pro telekomunikace a informatiku*. Brno: M. Filka, 2009. ISBN 978-80-86785-14-1.

[2] LAFATA, Pavel a Jiří VODRÁŽKA. *Optické přístupové sítě a přípojky FTTx*. Praha: České vysoké učení technické v Praze, 2014. ISBN 978-80-01-05463-5.